MEETING THE CHALLENGE:
U.S. INDUSTRY FACES THE 21ST CENTURY

THE U.S. ENVIRONMENTAL INDUSTRY

EXECUTIVE SUMMARY

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1. INTRODUCTION

This study focuses on the product and service industry that enables the U.S. and, to a lesser extent, other nations to meet their environmental objectives. Few industries will have a greater impact on the sustainability of economic growth and future prosperity in the U.S. Yet, the industry is viewed by its leaders as being in transition. The study therefore places significant emphasis on the critical policy choices that face the industry itself, its customers, and government. It also contains the thoughts of industry leaders—and many of their customers—about how government policies can provide a climate that is conducive to an improved competitive position of the industry. This is particularly important because of the potential support the industry can provide to other sectors of the economy in achieving simultaneously national economic and environmental objectives.

The environmental management system in the U.S. has brought undeniable environmental progress, making the nation's environment the cleanest in the world for the population and quality of life it serves. The products and services of the $181-billion per year environmental industry sit at the heart of this progress. The economic contributions of the industry—which in 1996 contained more than 110,000 revenue-generating organizations, employed more than 1.3 million Americans, and generated export revenues of more than $16 billion—are significant. The industry's 1994 revenues of $172 billion compare favorably with 1994 revenues in such industries as paper and allied products ($144 billion), petroleum refining ($128 billion), and aerospace ($105 billion), and are nearly as large as motor vehicles and car bodies ($198 billion). Employment in the industry in 1994 was larger than that in chemicals and allied products (824,000), paper and allied products (621,000), aerospace (535,000), and motor vehicles and car bodies (234,000).

Many senior industry executives, however, have revealed to the Department of Commerce (DOC) that the industry is at a critical juncture. What was a high-growth industry is now distinctly an industry in transition. Environmental regulations that created much of the market growth now have a diminished influence on demand. Since 1991, substantial compliance with existing regulations has been reached by most major industrial sectors—creating cost pressures on many of the industry's customers. Few new environmental legislative programs have been enacted, and fewer new regulations have been promulgated. With the erosion of regulation-induced demand, buying patterns for environmental products and services are undergoing a fundamental change: *from* a predominant

demand for pollution control, waste management, and remediation *to* an evolving demand for resource productivity and environmental improvements that enhance competitive advantage. As this change gathers momentum, the environmental market is beginning a shift from one dominated by activities making up for the past to one dominated by preparations for the future.

The leaders and many of their customers suggest that a broad-based U.S. environmental industry can provide products and services to enable the resource efficiency, high productivity, and sustainable growth which are necessary to a high quality of life in the U.S. and a spiraling population worldwide. They see the future of the industry as increasingly an engine for *simultaneous* economic growth and environmental protection, and believe that its customers will increasingly seek resource efficiency and economic competitiveness, as well as a continuing desire to control management decisions that are central to their operations. In addition, the industry leaders believe, their public sector customers face steady pressure to tighten budgets, limiting their ability to modernize and creating pressure to privatize. Industry leadership in these transitions will not only be sustaining, but also can leverage the environmental industry as an essential contributor to national environmental, efficiency, productivity, and sustainability goals.

2. The Environmental Industry Today

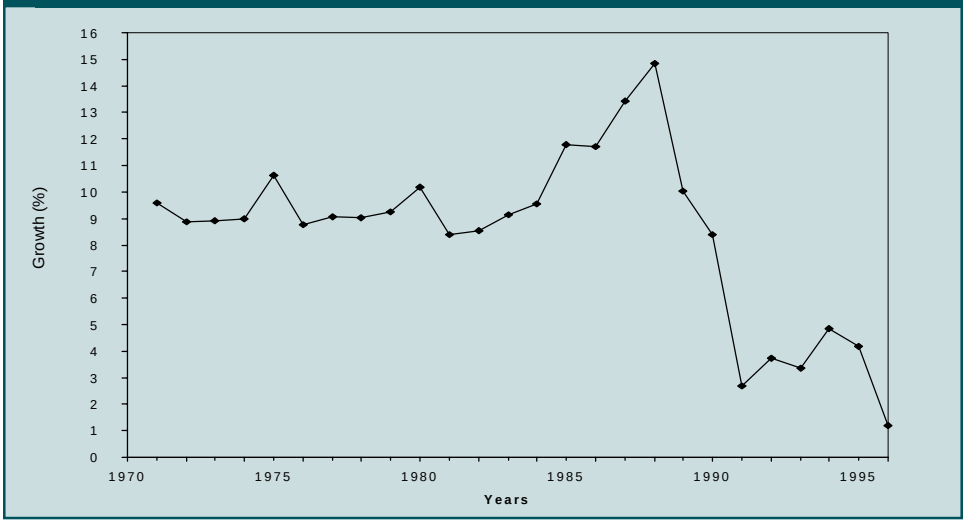
The domestic industry that provides environmental products and services is one of the least understood sectors within American industry, despite its size and economic importance. Yet, its influence on environmental quality and sustainable U.S. economic growth is great.

Part of the confusion concerning the industry results from its complex origins. The industry grew from a disparate set of public and private sector companies that provided two distinct types of products and services. The first type includes the historically public infrastructure services of potable water, wastewater treatment, and waste management. The second type includes firms in several segments of the industry that originated in a period of rapid growth following enactment and implementation of major domestic environmental legislation. These companies, most in the private sector, now provide the equipment and services needed for compliance with pollution control, remediation, and other environmental requirements.

These two major divisions of the industry have evolved into 14 diverse segments of mostly small companies as seen in data collected and maintained by Environmental Business International, the source of the most comprehensive data available on the industry. (DOC, working with the Environmental Protection Agency [EPA], is nearing completion of the first census survey of the industry.) This fragmented industry structure—with few companies spanning segments—has worked against the competitiveness of the industry in its home market and internationally. It has also led to a diminished public appreciation of the contributions of the industry and against the industry's ability to represent its concerns to government policy makers. Neither the public nor government, however, benefits from a lack of recognition of the activities that will have a central effect on the competitiveness of U.S. industry and the sustainability of the U.S. economy in the 21st century.

The U.S. environmental market has thus matured rapidly as an industry, although it has come to be overly dependent on demand-by-regulation and now suffers from waning regulation-induced market growth. Industry-wide annual growth that ranged between 10% and 15% in 1985–90 declined to 1%–5% between 1991 and 1996, as seen in Figure 1. Domestic investment in traditional approaches for environmental improvement has eroded. Many environmental companies are now in a "survival mode" with insufficient confidence to invest in a future with uncertain market demand. Virtually all 14 segments of this large

Figure 1. Annual Growth of Environmental Industry 1970–1996



and diverse industry now display the characteristics of a maturing industry: decelerating growth, heightened competition, growing customer sophistication, pricing pressure, consolidation of market share in larger players, reduced profitability, and heightened merger and acquisition activity are all in evidence. Without substantial reform in the framework of environmental policy, most leaders agree through economic or market forces rather than more regulations, demand will become even more uncertain with a direct effect on environmental industry competitiveness.

Industry Definition and Performance

The environmental industry includes all revenue generating activities associated with: (1) compliance with environmental regulations; (2) environmental assessment, analysis, and protection; (3) pollution control, waste management, and remediation of contaminated property; (4) the provision and delivery of the environmental resources of water, recovered materials, and clean energy; and (5) the technologies and activities that contribute to increased energy and resource efficiency, higher productivity, and sustainable economic growth (enabling pollution prevention).

The demographics of the U.S. environmental industry are unique in its variety of segments (see Table 1), number of entities, and mix of revenue-generating organizations in the public and private sectors. The industry is comprised of more than 110,000 revenue-generating organizations representing a unique blend of public sector and private sector participants. The majority of these organizations are in the public sector, providing potable water and wastewater treatment services to limited geographic areas. Among the private sector firms, the largest portion provides solid waste management services to communities in defined areas across the country.

Industry revenues and growth rates, organized by segment, are displayed in Table 1. Small and medium-sized revenue-generating entities

Table 1. The U.S. Environmental Industry 1988–1996

	Revenue ($ billions) and Growth (percentage)									
Environmental Industry Segment	**1988**	**1980–88 Growth**	**1990**	**1988–90 Growth**	**1992**	**1990–92 Growth**	**1994**	**1992–94 Growth**	**1996**	**1994–96 Growth**
Services										
Analytical Services	1.2	225	1.5	28	1.4	-7.8	1.3	-6.4	1.2	-10.6
Wastewater Treatment Works	18.2	67	20.4	12	21.5	5.4	22.7	5.6	24.0	5.8
Solid Waste Management	21.4	153	26.1	22	28.2	8.0	31.0	9.9	33.9	9.4
Hazardous Waste Management	4.7	662	6.3	34	6.6	5.2	6.4	-3.5	6.0	-6.6
Remediation/Industrial Services	6.7	1431	8.0	20	7.8	-2.6	8.4	8.7	8.6	2.1%
Consulting & Engineering	8.4	479	12.5	49	14.3	14.4	15.3	7.0	15.2	-0.6%
Equipment										
Water Equipment & Chemicals	12.0	73	13.5	13	14.7	8.4	15.6	6.6	17.5	12.1
Instruments & Information Systems	1.3	500	2.0	53	2.6	29.1	2.9	10.9	3.1	10.1
Air Pollution Control Equipment	3.7	13	13.1	254	13.8	5.0	14.5	5.4	15.7	8.0
Waste Management Equipment	8.8	120	10.4	18	11.1	6.7	11.2	0.9	12.0	6.9
Process & Prevention Technology	0.2	178	0.4	86	0.6	46.3	0.8	26.7	0.8	10.5
Resources										
Water Utilities	17.7	49	19.8	12	21.9	10.6	24.2	10.5	26.4	8.9
Resource Recovery	11.5	161	13.1	14	12.2	-6.9	15.4	26.1	14.3	-6.7
Environmental Energy Sources	1.4	-8	1.8	25	2.0	12.6	2.2	11.7	2.4	8.2
Total	117.1	115	148.9	27	158.5	6.5	171.9	8.4	181.1	5.4

Note: A fuller version of these data appears in the full text of this report.

Source: Environmental Business International, Inc., San Diego, CA. Copyright EBI Inc. May not be reproduced without written permission.

are a vital part of the industry. Firms with less than $100 million in annual sales generate a majority of industry revenues, and a large majority of firms generate under $10 million in annual revenues, most well under $5 million. Revenue growth that averaged in double-digits until 1991 has slowed or, in some sectors, become negative. The period of rapid growth, which correlated with the initial rush of new environmental regulations, is now behind most sectors of the industry. A high degree of compliance with existing environmental regulations by its customers, fewer new regulations, and the perception of softened enforcement have reduced demand for many of the industry's products and services.

The industry's poor financial returns reveal the diminished circumstances of many of its segments. Median profit margins that routinely exceeded 10% in the late 1980s are now in the 2%–3% range in service segments that are suffering reduced or negative growth. Stock market performance is another indicator of industry difficulty. Since 1991, the average annual return of the Environmental Business Journal (EBJ) Index of 240 environmental companies is 6%. This compares with the NASDAQ (22%), Dow Jones (16%), and the S&P 500 (14%) over the same time period. The environmental industry also has a poor record of attracting capital for venture-stage and public financings. Venture capital placements in environmental technology companies have fallen steadily from more than $200 million in 1991 to less than $20 million in 1996.

Environmental companies' investment rate in R&D for new products and services is very low, and R&D investment is concentrated in about half of the industry's segments. Many U.S. engineering, environmental infrastructure, and service companies make no investments in technology R&D and product development. The number of companies on the equipment side investing in research continues to decline because of market uncertainties.

Under these new economic conditions, the domestic industry has begun to display the characteristics of a maturing industry. In addition to decelerating growth, these characteristics include heightened competition, growing client sophistication, greater emphasis on marketing, consolidation of market share in larger players, reduced profitability, and heightened merger and acquisition activity. Many companies are responding to these changes by focusing on internal cost controls, a step that may help short-term profitability but can rarely build long-term competitiveness.

Industry representatives and observers of the industry in the financial community agree that rapid growth in the domestic market bred a level of complacency in U.S. environmental companies that has now vanished. These industry leaders and observers agree that the industry has entered a transitional period which will continue for several years, barring a new surge of environmental regulations that could inject new growth into the domestic market. They also observe that, internationally, the preponderance of smaller firms diminishes the industry's overall competitiveness, as smaller companies are less able to export.

Varying Competitiveness of the Industry's Sectors

The United States' environmental industry, the world's largest, possesses the most varied set of talents and capabilities. Fed by pioneering U.S. environmental policies, the technology, engineering, and systems management skills crucial to addressing environmental challenges initially developed in our home market. Being the first and the largest market, however, did not ensure that the domestic industry would remain the world leader. Although the industry boasted a trade surplus of $9.3 billion in 1996, U.S. firms in several sectors appear to be falling behind their foreign competitors, as seen in Table 2. These subjective rankings of competitiveness are based on strength of technology, finance, and management, as well as size and global presence of top competitors in each segment.

In general, the U.S. environmental industry is very competitive in most environmental service segments, but trails in some equipment segments. U.S. companies rate highest in such segments as solid waste management (in which the industry is notably competitive), hazardous waste management, engineering, remediation, and analytical services, as well as in information systems. Many of the service segments that possess a comparative advantage—e.g., consulting & engineering, analytical services, and remediation—are not those in strongest demand either in the established markets of the developed world or in developing markets. The U.S. has an affirmed leadership in environmental instrumentation, a segment from which U.S. companies generate the majority of their export revenues, and in the management of large construction projects. U.S. firms are moving rapidly into the fast-growing pollution prevention sector, but this sector represents only about 1% of the industry's total revenues.

Table 2. Environmental Industry Segments

Segment	Description	Examples of Clients
Environmental Services		
Environmental Testing & Analytical Services	Provide testing of "environmental samples" (soil, water, air, and some biological tissues).	Regulated industries, government, environmental consultants, hazardous waste and remediation contractors.
Wastewater Treatment Works	Collect and treat residential, commercial, and industrial wastewaters. These facilities are commonly known as POTWs, or publicly owned treatment works.	Municipalities, commercial establishments, and all industries.
Solid Waste Management	Collect, process, and dispose of solid waste.	Municipalities and all industries.
Hazardous Waste Management	Manage ongoing hazardous waste streams, medical waste, nuclear waste.	Chemical and petroleum companies, government agencies.
Remediation/Industrial Services	Provide physical cleanup of contaminated sites and buildings; provide environmental cleaning of operating facilities.	Government agencies, property owners, industry.
Environmental Consulting & Engineering	Provide engineering, consulting, design, assessment, permitting, project management, operations and maintenance, monitoring, etc.	Industry, government (including municipalities), waste management companies, POTWs.
Environmental Equipment		
Water Equipment & Chemicals	Produce equipment, supplies, and maintenance in the delivery and treatment of water and wastewater.	Municipalities and all industries.

Table 2. *Continued*

Segment	Description	Examples of Clients
Environmental Equipment		
Instruments & Information Systems	Produce instrumentation for the analysis of environmental samples, and provide information systems and software.	Analytical service companies, government, and regulated companies.
Air Pollution Control Equipment	Produce equipment and technologies to control air pollution, including vehicle controls.	Utilities, waste-to-energy industries, auto industry, other industries.
Waste Management Equipment	Produce equipment for handling, storing, or transporting solid, liquid, and hazardous waste, including disposal, recycling, and remediation equipment.	Municipalities, waste-generating industries, solid waste companies.
Process & Prevention Technology	Provide equipment and technology for in-process (rather than end-of-pipe) pollution prevention and waste treatment and recovery.	All industries.
Environmental Resources		
Water Utilities	Sell water to end users.	Consumers, municipalities, all industries.
Resource Recovery	Sell materials recovered and converted from industrial by-products and postconsumer waste.	Municipalities, waste-generating industries, solid waste companies.
Environmental Energy Sources	Sell power and systems in solar, wind, geothermal, small-scale hydro, energy efficiency, and DSM.	Utilities, all industries, and consumers.

Note: A fuller version of these data appears in the full text of this report.

Source: Environmental Business International, Inc., San Diego, CA.

U.S. firms trail in a number of major, established sectors such as water and air pollution control equipment. In several important country markets, advanced regulations and innovative policies have stimulated the development of more effective technologies and companies, particularly for a number of water and air applications. The domestic industry is also largely uncompetitive in the construction, management, and operation of potable water and wastewater treatment systems, where U.S. companies possess competitive technical capabilities but are non-competitive in business and financial areas. The U.S. entities are predominantly in the public sector; as such, they are regionally focused and not dependent on returning value for shareholders. The resulting lack of business and financial capabilities weighs against the industry's participation in what are, near term, the greatest opportunities for increased environmental revenues in the developing world. By contrast, the leading firms originated in the privatized companies of the French and British water industry.

3. Forces That Shape the Environmental Marketplace

The nature of the demand for environmental products and services is evolving rapidly in all sectors of the market. Industry leaders believe changes are being caused by the combined impact of our domestic environmental regulatory system and dramatic, but still unstable, shifts in customer expectations. No large group of customers—domestic or international, public or private—is standing still. These factors have failed to develop an industry that can thrive, long-term, outside the confines of an imperfect market stimulus provided by today's regulatory system, industry leaders suggest. They have left most U.S. environmental companies ill suited to compete internationally where a substantially different mix of motivating mechanisms shapes the environmental market.

In examining the deterioration of the competitive position of many U.S. environmental companies and their opportunities for the future, however, industry leaders point paradoxically to a domestic climate in which business was handed them by the strong arm of environmental regulation backed by unquestioned popular support. While the market burgeoned, competition often meant having a business card and a brochure. In practice, regulations in this compliance-driven market constrain the choice of environmental solutions and dictate the timing of compliance. The "command and control" system thus discourages innovation and makes the use of innovative technologies difficult. It also places environmental companies at psychological odds with their customers.

Changing Customer Expectations

Private Sector Customers

Three broad approaches to environmental management are now visible among private sector customers. These three approaches involve varying corporate strategies to environmental decision making, including the decision factors, location of decision makers in the corporate structure, the inclusiveness of processes, and the participants. It should be noted that all three approaches have an underpinning in the floor of performance set by EPA and state and local environmental agencies; it is this floor and its enforcement that provides a primary motivation to regulated companies to make expenditures that benefit the environment.

The industry's customers began with a "traditional," compliance-oriented approach to the purchase of environmental services and products, which strongly predominates, and are now moving through "transitional" approaches to an "advanced" approach which more fully integrates environmental and economic decision making.

The "traditional" customers, the largest group of private-sector customers, seek direction from and respond to government-imposed environmental requirements. They primarily choose end-of-pipe solutions that treat pollution after its formation, rather than avoiding waste and its associated pollution. They manage for environmental compliance. Their substantial compliance with regulations has brought environmental performance in the U.S. from deplorable to acceptable in major industrial sectors. A number of smaller industries and non-point sources remain largely out of compliance, and these present a continuing challenge to EPA in its traditional regulatory/enforcement method of operation.

"Transitional" customers have expanded their approach to environmental decision making beyond questions of compliance with regulations. They have begun the process of making decisions that optimize economic and environmental decisions or simultaneously consider economic and environmental factors, and they consider a wider range of options, including some that reduce waste and the generation of pollution.

The "advanced" customers in the private sector make profound shifts in their organization that expand the factors and participants in decision making. They integrate environmental factors in their decisions more fully than other firms, adopting advanced production processes and product designs that are economically and environmentally advantageous. They regard productivity and technology as key drivers of manufacturing strategy, invest more in process and product R&D, and make greater use of quality-based strategies. They also realize the value of a positive environmental perception in the marketplace, and reflect that in their communications strategies.

The small, but growing, proportion of firms that use the "transitional" and "advanced" approaches is leading a shift in demand for environmental products and services. Demand is increasing, for example, for new types of products and services that enhance the efficiency of production processes, thereby reducing pollution. Similarly, more customers are seeking environmental services that are multi-media, or integrated, in nature. These firms have told their environmental product and service providers that their future competitiveness is dependent on continued

movement in this direction. Overall, they are shifting their demand solutions that turn costs into productive investments, reflecting the need to make both economic and environmental progress in their operations.

These customers, which are only a very small minority of the regulated community, have also told their environmental suppliers that broadening this trend beyond a select few is dependent on two factors: new incentives and the replacement of "command and control" as the predominant means of ensuring a floor under the environmental performance of all regulated parties. They are questioning the benefits of their investments in the absence of market advantages to advanced environmental performance. They say that a floor is necessary, but that the barriers and disincentives inherent in the "command and control" strategy impede their use of advanced solutions and limit their ability to capitalize on their investments. Also, without broader economic consequences for poor environmental performance, "advanced" companies believe they are putting themselves at a competitive disadvantage compared to traditional and recalcitrant companies. The floor of "command and control" has provided for acceptable environmental performance, but provides no incentive for "transitional" and "advanced" approaches. These customers seek from regulators increased independence to choose solutions for their environmental challenges, rather than relying on guidance or mandates.

Public Sector Customers

Governmental authorities that provide environmental services to their customers generate about one-third of industry revenues. These authorities are concentrated in the potable water and wastewater sectors, although there are many in the solid waste and recycling sectors, as well. These service authorities are large purchasers of products and services from other segments of the industry (e.g., equipment suppliers and laboratory services). The largest public sector customers of the industry at this point in time, however, are federal agencies in charge of the cleanup of contaminated sites.

Budgetary constraints and, more broadly, changing expectations of the roles of government are reshaping the environmental services market. Voters across the country are demanding more efficiency in, and lower costs for, these services, squeezing the revenue base of the authorities. While much of the U.S. environmental infrastructure is in need of upgrade, insufficient public funds are available to meet the task. Similar resource constraints are slowing the cleanup of federal sites.

New strategies for privatization of environmental infrastructure and of the cleanup work at federal sites are gaining momentum, along with incentives for the use of alternative solutions. To the extent these are adopted in federal procurement practices, increased efficiency and lower cost will come into play, and demand for innovative technologies and services will gain.

The Emerging Global Market

The rapid growth in overseas environmental markets has changed the U.S. environmental industry forever. With increased competition and declining profits in the U.S. home market, more companies are looking to foreign markets for opportunities to improve return on investment. Whether they seek to provide environmental infrastructure in developing markets or advanced products and services to foreign industrial customers, companies in the environmental industry see great opportunities in the increasing and changing demand overseas.

The $453 billion global environmental market is growing faster than the global economy and at a pace that outstrips growth in the U.S. environmental market, as seen in Tables 3 and 4. This market is made up of two distinct parts: industrial markets where demand may be as sophisticated as in the U.S., and developing markets where demand is dominated by the need for environmental infrastructure (e.g., potable water, wastewater treatment, and solid waste disposal).

The most rapid market growth is occurring in the developing nations where booming populations, high-paced urbanization, and technological advances place tremendous burdens on the environment and create an enormous demand for improved infrastructure. In many of these countries, an environmental crisis of incomparable proportions threatens both today's and future generations. Demand in many of these countries is limited more by the inability to pay than by an absence of regulations requiring environmental protection.

Table 3. Global Environmental Market Growth

Country	1996 ($billions)	1995–96 (percent)	1996–00 (percent)
USA	171.8	0.8	1.8
Western Europe	133.6	3	2.8
Japan	87.1	2	2.6
Rest of Asia	18.9	16	10
Latin America	8.8	12	12
Canada	11.6	3	3
Australia/NZ	6.8	5	4
Eastern Europe/CIS	7.1	6	8
Middle East	4.3	6	8
Africa	2.2	10	10
Total	**452.2**	**2.7**	**5**

Source: Environmental Business International, Inc., San Diego, CA.

Table 4. U.S. Environmental Export Performance

	1993	1994	1995	1996
Global Market ($ billions)	412	428	440	452
U.S. Market ($ billions)	160	166	170	172
Non-U.S. Market ($ billions)	252	262	270	280
Exports (%)	5.9%	6.7%	8.2%	8.8%
U.S. Exports ($ billions)	9.6	11.5	14.7	16.0
Trade Surplus ($ billions)	4.8	6.2	8.5	9.3
U.S. Share of Non-U.S. Market (%)	3.8%	4.4%	5.5%	5.7%

Source: Environmental Business International, Inc., San Diego, CA.

In developed countries and some developing countries where high technology industries are locating, demand exists for advanced environmental products and services. This demand is usually defined differently than demand in the U.S. because regulators are more amenable to using economic instruments than are regulators in the U.S. (e.g., pollution taxes, discharge fees, negotiation, and land use changes to encourage more sustainable behavior without the use of conventional regulatory instruments). Experimentation with flexible regulatory processes is quite widespread, as is experimentation with market forces, and economic value sometimes comprises a greater part in the choice of environmental solution. For example, Poland uses air pollution taxes, China uses wastewater discharge fees, Holland and Korea uses packaging deposit/refund systems, Indonesia and Brazil use watershed charges, Malaysia and Guatemala use carbon offsets, Thailand uses tradable non-compliance permits, and China and Germany use overcompliance credits. In addition, customers often seek multimedia environmental solutions, challenging environmental companies to expand their range of products or services. Where multi-national companies' facilities are the source of this demand, their environmental objectives may equal those required in the U.S. despite the lack of equally stringent requirements in the host country.

U.S. companies face stiff competition in all of these markets. The nations of Japan, Germany, Great Britain, Canada, France, Korea, the Netherlands, and Scandinavia, just to name a few, have coordinated domestic environmental and export strategies aiming to win the battle for global market share. These efforts include export support (including "tied aid"), business training, favorable financing packages, and technology and knowledge transfer, along with domestic market development and technology friendly policies, including research and development support, in order to hone the competitiveness of their environmental industries.

The U.S. environmental industry has noticeably improved its performance in international markets in the past few years, though there is still room for improvement. Led by exports of recycled metals, environmental exports increased from $9.6 billion in 1993, to $11.5 billion in 1994, to $14.5 billion in 1995, and to $16 billion in 1996, producing a trade surplus of $9.1 billion for that year. Despite this 64% growth in three years, the U.S. environmental industry still generates only 9% of its revenues from outside its borders (compared to 15%–20% for our major competitors in Japan, Germany, and other countries in Western Europe), and U.S. environmental companies have gained only 5% of the markets outside the

A Longer Term Challenge: An Economic Framework for Sustainability

In order to stimulate consistent demand for environmental products and services and to create incentive for continuous environmental improvement in the regulated community, environmental industry leaders, academics, and progressive policymakers believe economic policies must be instituted to value the environment in national and international economic systems. Internalization of the value of wasted resources, pollution, and environmental degradation (the environmental "social costs" or "externalities" that are borne by everyone, rather than those who cause them) into economy-wide accounting and, therefore, into the everyday calculations of individual businesses will enable the free market to accurately reward environmental excellence and punish environmental malfeasance.

With policies that generate predictable economic consequences for unsustainable behavior, investments in environmental improvement will be continuous until a maximal point of economic and environmental sustainability is reached. While today's markets do little to account for environmental degradation and unsustainable resource consumption, future economic policy—stimulated by international environmental agreements and trade concerns—will center around these issues. The fundamental adjustment of our accounting system to value the environment can serve as the framework of sustainable economic policies and rational environmental policies.

Translating the value of clean water, clean air, and unspoiled land into economic terms remains a daunting if not impossible task, but these measures must be taken if society is to start moving toward greater resource sustainability, the leaders suggest. If it was the challenge of the past 25 years to reverse the pace of environmental degradation, the challenge of the next 25 years is to construct the foundations for a sustainable national and world economy.

Industry leaders suggest that this reform be implemented through a greater use of market-based instruments. These tools would effect incremental *economic consequences* for each increment of environmental degradation, and *reward* each increment of improvement. Examples include discharge fees, environmental taxes, resource sustainability ratings, release inventories, and other economic and informational instruments designed to internalize environmental externalities.

While these issues represent the framework for a competitive and more sustainable economy and for future competitiveness of the environmental industry, they remain distinctly over the horizon in terms of short-term business tactics for environmental companies. However, companies and industries rarely remain on top or gain a leadership position in a particular market relying solely on tactics. The essence of business strategy is long-term vision, and many executives believe they must be devoted to creating this vision of sustainable economic policy for their companies, for the collective environmental industry, and for the environment.

United States. In addition, imports into the U.S. market are also growing, necessitating continued industry investment to preserve and expand competitiveness, and foreign competitors have acquired a number of significant U.S. environmental firms.

U.S. companies have significant opportunities. Overall, global market needs outpace the capacity to provide environmental solutions. Many U.S. companies, especially larger ones, have taken steps to participate, and more companies can and will in the future, providing a wider and wider range of products and services needed by potential customers worldwide. Most smaller and medium-sized firms, however, will continue to have difficulties extending their businesses internationally because they lack the necessary financial wherewithal and integrated products and services to compete.

The Changing Value of Regulatory "Command and Control"

The regulatory-driven, "command and control"-based U.S. environmental management system has served a very valuable purpose for the American public by improving environmental quality locally and nationwide. Industry leaders and other observers believe, however, that it has been apparent for some time that traditional methods have passed the point of diminishing returns. These executives believe, in fact, that our domestic system of environmental regulation hobbles the competitiveness of the U.S. environmental industry, increases environmental costs, and discourages the adoption of innovative solutions to environmental problems. Not only does each increment of new prescriptive regulation result in less "return" in terms of social benefit, in their view, but the environmental industry's dependence on government regulation to create customer demand has narrowed its competitive strategies, channeling its products and services *towards* the compliance objective and *away* from the core business objectives of its customers.

The United States has relied, from the beginning, on regulatory activity to bring about corporate compliance with environmental standards. Our economic system does not set a price on the environment and, as a result, absent environmental regulation, people used the environment as a "free good." Before regulations, no costs were associated with the disposal of wastes to the environment, and companies that incurred costs to avoid disposal to the environmental "commons" were at a competitive disadvantage. In these circumstances, little economic incentive existed for efficient resource management. Moreover, the consequences of unsus-

tainable extraction and utilization of resources were not accounted for. The net result was both severe economic and social inefficiency *and* environmental damage that became increasingly apparent—and intolerable—as the population and economy grew. In these pre-regulatory circumstances, minimal demand was present for the services and products of most sectors of the environmental industry. The only significant parts of the pre-regulatory environmental industry were those that provided infrastructure services, specifically for potable water, liquid waste collection, and solid waste collection and disposal.

Regulations, which established a "floor" for acceptable environmental performance, and their enforcement quickly became the mechanism of choice for assuring environmentally responsible behavior in the United States. They provided an effective, but technically prescriptive, response to the collective public demand for a legal framework to change polluting behavior and punish the worst offenders. The "command and control" environmental management system in the U.S. brought undeniable progress in environmental management and has arguably made the environment in the U.S. the cleanest in the world for the population and quality of life it serves.

Regulations were just the first step toward changing the environment's status as a "free good" in the U.S. Regulated pollutants, once they are formed, can no longer be freely released or thrown away. Compliance with environmental regulations has become a significant cost item, exceeding 10% of total costs for some industries. Vigorous, steady, and evenhanded enforcement of this regulatory "floor" is essential to a stable marketplace in which business risks can be measured and managed.

In this system, however, costs of compliance have almost uniformly been incurred *after the fact* of the formation of pollutants. And, environmental expenditures have focused on minimizing the negative consequences of pollution, waste accumulation, or contamination, rather than on *preventing* them. Thus, the "command and control" approach to regulation has unintentionally decoupled the value of environmental gains from their costs—compliance is a requirement regardless of its benefits. The majority of the regulated community has viewed and still views this approach as a burden and a drain on productive business activity.

Environmental industry executives believe that this "command and control" approach has encouraged the pursuit of acceptable environmental performance without creating systemic incentives to reward excellence and continuous improvement beyond minimal compliance. In the

present regulatory system, if the bar is set for a regulated entity and then cleared, the compliance process is largely complete—as is most of the demand for external environmental expertise and hardware provided by the industry. Raising the bar further may reignite demand, but this standard-based system has understandably led to sporadic and unpredictable demand for environmental products and services. Likewise, the regulatory system fosters the perception that environmental providers are only needed temporarily—to fix a problem or clear a regulatory or legal hurdle.

As long as regulated communities regard the costs of environmental performance as separate from investments for resource productivity, uncertainties will continue to plague the environmental industry concerning customer demand for its products and services. This vulnerability is reflected in the industry's overall precarious financial condition, in its poor record of return on investment, in the lack of financing for environmental companies and projects, and in the low rate of investment for developing and deploying new environmental solutions. It is also revealed in widespread resistance to more regulations that respond to the public demand for additional environmental protection.

In the view of industry leaders, "command and control" has thus "positioned" the environment as a *cost*, not an *opportunity*, in business decision making. Environmental compliance is bought with expenditures for equipment and services; regulatory processes are grounded in technologies, techniques, and practices that are predominantly end-of-pipe. These increase the cost of business and offer few, if any, advantages to their users to find the links between environmental progress and economic productivity (or efficiency) gains. "Command and control" also carries high process (or transaction) costs, offers little flexibility, and burdens the development and use of innovative environmental technology solutions with numerous severe barriers. In industry's view, the "command and control" approach has therefore not supported the development of long-term relationships between environmental companies and their customers based on mutual business interests; both environmental industry competitiveness and the long-term competitiveness and sustainability of the entire U.S. economy suffer.

The leaders conclude that the very pace of environmental improvement is thus being slowed by "command and control." This occurs in two ways. First, the environmental management system offers little incentive for technology innovation or investment to exceed acceptable environmental performance and no reward for above average or excellent envi-

ronmental performance. Being in compliance is sufficient. Second, it harms U.S. competitiveness by offering little encouragement to linking environmental and economic decisions.

The barriers and other inefficiencies of "command and control" also cause a lack of investment capital for the U.S. environmental industry. This capital shortage is manifest in the unmet needs for both operating capital for growing companies and technology development and commercialization capital. The second gap becomes more severe as technology products approach the marketplace. This deficiency is now commonly known in the industry as the "Valley of Death." Sufficient capital exists for most basic and early applied R&D, but relative availability declines as technologies evolve along the commercialization cycle up to and including commercial introduction. It is only when regulatory approval of use is received and the product is generating sales that commercial potential can be assessed and investors are again willing to supply capital. The "Valley of Death" in capital availability thus swallows up many new environmental products and services before they reach the marketplace. So, the environment suffers, the economy suffers, and the industry suffers.

4. The Industry's Concerns for the Future

The U.S. environmental industry is at a turning point. Industry leaders and many of their customers suggest that the next few years are pivotal in light of evolving domestic market needs, strong competition for a static level of U.S. demand, and rapidly growing international environmental markets that are motivated by qualitatively different governmental policies. The primary choices for evolving products and services to meet market demand rest with the industry itself. Industry leaders foresee new products and services that will impact the competitiveness of not only the industry, but of its customers and the entire U.S. economy. This viewpoint reflects the potential of the industry to contribute to resource productivity, as well as environmental management.

Industry leaders and many of their customers believe, as well, that the government has several essential roles to play: in reforming regulatory policy, in partnering with industry more effectively to facilitate the development and diffusion of new technologies, and in using other government policies and programs to shape the climate in which the industry must compete. They believe that a two-track strategy for reforming the federal-state system of environmental policies and regulations is crucial. Systemic reform, not more experiments and initiatives, will replace "command and control" with regulations that emphasize environmental performance, de-emphasize administrative process, and reward total environmental performance and technology innovation. And, the leaders offer that a partnership between the industry and government can lead to a more competitive economy, greater wealth and job creation, and the reemergence of the U.S. as the leader in environmental protection worldwide.

The leaders identify four major areas where actions are needed to improve the industry's competitiveness. These are: (1) reinvention of the domestic industry to respond to the dramatically shifting market; (2) reform of the government's role in creating private- and public-sector markets for environmental products and services, and in fostering new technologies; (3) meeting the challenge of global markets through a closer industry/government partnership and increased industry competitiveness; and longer-term, (4) valuing the environment in national and international economic systems rather than allowing its free exploitation.

Reinvention of the Environmental Industry

The parameters of competition are changing and the future competitiveness of the industry will center around its ability to deliver value rather than simply fix problems. Increasingly, it needs to sell productivity *plus* compliance, business solutions *and* environmental solutions. There will always be a market for "tacked on" pollution control equipment and waste management services, but it is declining in importance. In the future, industry leaders believe they must sell products and services that more fully contribute to the core businesses of their clients. They must emphasize the future benefits of environmental excellence and resource productivity, while continuing to help their customers make up for past negligence. Resource delivery and resource productivity, highlighted by the volume of revenues or user fees flowing through water and wastewater segments and energy markets, will be the key to future success.

In a broad context, an opportunity exists for environmental providers to become *resource* managers as well as *environmental* managers, more fully integrating their products and services with the core business interests of their industrial and government clients. All types of resources represent opportunities: the traditional physical resources of water, energy, raw materials, and land, as well as less obvious assets like people, property value, and information. *In sum, the industry believes it must:*

- *Sell value, not just technical compliance fix-its.*
- *Deliver resource productivity to enhance competitive advantage for its customers, and itself.*
- *Integrate environmental management with customers' overall business strategies, using such methods as "strategic environmental management" and ISO 14000.*

In addition, industry leaders are developing the perspective that they must develop a collective voice on environmental policy. They express the view that the industry is a missing, but critical, third voice in the formation of environmental policies of the future. The environmental industry is both pro-environment and pro-business, in their view. With one foot in each camp of the environmental policy debate, the industry can guide the adoption of environmental management policies that benefit the environment while enabling regulated companies to manage

their businesses and to be competitive. In the absence of this industry voice, in their view, environmental policies have become too process oriented and inefficient, resulting in a barrier to the technology changes necessary for national competitiveness. Overreliance on "command and control" also has the undesirable effect of capping environmental progress, rather than enabling its continuous improvement.

Government's Role in Creating Markets and Fostering Technology

Industry executives and many of their customers identified several essential steps government must take in response to the deterioration of the compliance-driven market, the business needs of their customers, and the globalization of demand. These steps can be generally grouped into three areas: reform of the regulatory mission of the EPA, reform of government's own environmental management activities, and revamped governmental support for technology development and diffusion. Systemic change, rather than more experiments and initiatives, is seen by these business leaders and many of their customers as critical.

First, they believe that a two-track strategy for reforming the federal-state system of environmental policies and regulations is essential. To start, many industry executives now propose that the traditional, punitive, technologically prescriptive "command and control" system be replaced. The new approach, in their view, must be based on the effective integration of their customers' environmental and economic concerns, and on the link between resource efficiency and national economic competitiveness. They feel that regulated companies should be judged by their environmental performance, that companies should be encouraged to manage environmental outcomes as a part of their normal business decision processes and to seek integrative solutions. This approach (building on the direction of such experiments as EPA's Project XL and the "Common Sense Initiative") would allow companies they serve to make environmental performance a positive competitive factor and can create incentives for environmental excellence and technology innovation. The industry leaders suggest two guiding principles for this policy and regulatory reform to assure that polluting behavior will be penalized and excellence will be rewarded:

- Maintenance of a regulatory baseline, though *without* the barriers inherent in "command and control" and *with* strong enforcement, to define the "floor" for environmental progress,

offer problem-solving flexibility, and maintain a legal mechanism for penalizing environmental criminals.

- Shifting to a fundamental reliance on performance-based policies (including market mechanisms) and information-based policies (like the Toxics Release Inventory) to achieve two results: (a) rewards for environmental excellence and creation of incentives for environmental performance above the floor, and (b) encouragement for companies to integrate the environment into their core business decisions (through, e.g., lower transaction costs related to compliance; greater flexibility to achieve environmental results simultaneously with other business objectives, all of which save money and increase productivity).

The most potent approach to increasing the efficiency of the environmental market is to make greater use of incentives and rewards, information, more flexible regulatory processes, encouragement for innovation, and fiscal and tax policy reforms. These approaches, *applied systematically and system-wide*, will stimulate the *demand* side of the market. This will achieve a more efficient market, which will, in turn, better attract investment and growth capital to the environmental industry, as well as financing for its projects (as today's SO_2 emissions trading program does in a more narrow context). The reforms' use of performance-based mechanisms (experimented with in, e.g., New Jersey's multi-media permits, media-specific markets established under the Clean Air Act) will reward technology innovation and creative environmental problem solving. Information-based mechanisms (e.g., expanded self-reporting, remote monitoring, and environmental liability disclosure) will provide better data to the public, shareholders, and government officials to enable more public accountability for unsustainable behavior. The demand created by providing incentives to improve environmental performance and to go "beyond compliance" will provide more opportunities to create profitable companies on the *supply* side of the equation and, thus, to attract capital. Linking environmental and economic decisions through a common denominator—money—will create even more opportunities. A broader market and more efficient operating conditions within it will be, by far, the most effective way to bring more capital to this industry and, thereby, to alleviate the condition known as the "Valley of Death."

Industry leaders believe that these policies can inform and empower the market, allowing it to more effectively and efficiently protect the environment. They propose that EPA and state and local agencies shift their

focus from prescription, compliance, and enforcement to requirements setting and performance auditing. This step has the potential, the leaders believe, to change the culture of industrial environmental management from cost and resistance to revenues, profits, and partnership. It also has the potential, they propose, to enable *simultaneous* sustainable economic growth and environmental progress.

Second, industry leaders suggest, when government agencies are the customers of the environmental industry, they should procure performance, not hours and effort. Key market-enhancing improvements, such as performance-based procurement, procurement cycles that are directly related to private sector investment cycles, the institutionalization of rewards for contractors that save time and money (as at Hanford, Rocky Flats, and other DOE sites), and improved allocation of contract risks are needed. This need is particularly great, they propose, in the environmental remediation product and services market dominated by the Departments of Energy and Defense. By procuring results—directly or indirectly through privatization of the project management role, as in DOE's recent privatization initiative—government agencies can accelerate cleanup and reduce its cost. Some industry leaders noted the potential for a positive governmental role in creating markets for environmentally preferable products (such as in DOD's "affirmative procurement" program and several Executive Orders that use government procurement to build markets).

Third, industry leaders suggest that government must also reexamine its role in the development and commercialization of environmentally beneficial technologies and in technology policy. Government must restructure its R&D investments to facilitate *private sector* technology innovation, increase government-industry collaboration on new technologies, and seek the technologies of sustainability. They note the need for a greater governmental role as convener in R&D activities, sponsor of basic research (as with NSF and DOE), facilitator of demonstration and commercialization, and facilitator of public acceptance of new technologies. In this regard, the leaders noted such positive programs as the DOC/Industry Partnership for a New Generation of Vehicles, DOE's Industries of the Future program, DOD's Environmentally Conscious Manufacturing Consortium, and EPA's Design for the Environment Program. Industry leaders feel strongly that it is vital for technology-friendly policies to address significant barriers to entry for new technologies that exist within the entrenched, technologically prescriptive environmental regulatory system: risk-averse regulators, permitting restrictions, fragmentation of the U.S. environmental market, and difficulty in

establishing equivalent performance continue to be substantial barriers to innovation, along with wider-ranging changes than will stimulate environmental markets (e.g., regulatory flexibility). The leaders desire a national, market-enhancing verification process for new environmentally beneficial technologies, noting slow progress in this direction (as reflected in the 6-state memorandum of understanding for interstate verification cooperation and in EPA's various Environmental Technology Verification "pilots"). They note that liabilities associated with non-performance—however minimal—also inhibit the testing and use of new environmental technologies, further hampering the development of new environmental products and services. One frustrated executive characterized continuous innovation as a climate of trial-and-error, but described EPA's new technology protocol as error-and-trial.

Opportunities exist to bring down these and other barriers to technology innovation and to enhance the effectiveness of government and private sector technology relationships. In this context, as well, the industry leaders emphasize that it is time for systemic action (across the environmental media, across the levels of government, across the spectrum of technologies) to favor environmentally beneficial technology change, not merely initiatives and experiments. Central to these are: (1) changes in regulatory policies, (2) the advent of a system of technology-stimulating R&D policies and programs that includes facilitation of private sector R&D and product innovation, (3) increased collaboration with industry in partnerships for the technologies of the future, and (4) redistribution of government R&D resources to increase support for the technologies of future sustainability. Neither large increases in government funding for R&D nor large infusions of government-supplied investment capital were suggested. In addition, many program changes were proposed, including a market-enhancing system for verifying technology performance, wider interstate regulatory and permitting cooperation, improved federal-state coordination for new technologies, cooperative demonstrations tied to procurements, and two-way commercialization programs where government-developed technologies are matched with companies that are capable of bringing them to the market.

Industry executives suggest major reforms in government *R&D* programs related to environmental technology, including greater federal concern that federally financed intellectual property yield real products in the marketplace. Other nations, most notably Japan, have much stronger ties between government and private sector non-military R&D. The vast majority of U.S. government technology R&D related to the

environment over the past two decades, which amounts over $100 billion, has been conducted with little direction from the market or input from the private sector, and the many recent R&D initiatives have not yet led to systemic change. Industry leaders have suggested that several steps are key, notwithstanding these initiatives:

- Investing a greater portion of *public* technology R&D resources to facilitate the success of *private* sector R&D. Greater marginal returns on governmental R&D investments are available from the facilitation process than from any other use.

- Increased collaboration between governmental and private sector technology development efforts. The combination of the business expertise of the private sector with the government's scientific and technical competence can lead to a greater success rate in development efforts sponsored by both.

- Coordination of environmental R&D programs across agencies and funding sources.

- Redistributing R&D resources to increase support for the technologies of future sustainability.

Industry leaders also suggest that the government facilitate the *diffusion* of resource-efficient products and services, making the industry more attractive to capital, by providing financial incentives for the development and use of new technologies. These incentives might include:

- Bonuses/incentives for early adopters of innovative technological solutions**.** A variety of regulatory process (e.g., extended permit life, interstate regulatory cooperation) and other bonuses and incentives (e.g., tax and depreciation advantages) can allocate the increased risks associated with early adoption of innovative solutions. More broadly, a portfolio of regulatory drivers, rather than "command and control," can create incentives and disincentives for positive and negative environmental behavior.

- An improved governmental role as buyer and risk mitigator. Government procurement of environmental equipment and services can be shifted from the cost/plus method to performance-based. Government-backed finance can be an

important bridge through the use of such vehicles as a FNMA-type vehicle, SBA's authorities for small business assistance, and export assistance.

- Full cost accounting. Over time, full cost accounting can place environmental costs within the fiscal and accounting systems used by countries and businesses, bringing environmental and other business decisions into a common framework.

In sum, the environmental industry believes that government at all levels must:

- *Reform the federal-state system of environmental policies and regulations.*
- *Improve government markets for environmental products and services.*
- *Establish a system of technology-stimulating policies in regulations and R&D programs.*

Industry and Government: Meeting the Global Challenge

The global market for environmental products and services now exceeds the U.S. market in annual dollar value and is growing rapidly. This market is made up of two distinct parts: industrial markets where demand may be as sophisticated as in the U.S. and rapidly developing markets where environmental infrastructure for potable water, wastewater treatment, and solid waste disposal dominates. Prospects for growth in demand for the U.S. environmental industry are very promising, especially for larger U.S. firms.

The U.S. has a major economic interest in capturing market share in infrastructure development, as well as competing more successfully in advanced environmental markets. Infrastructure construction markets in the developing world represent a multi-trillion dollar market over the next two decades. Growth in infrastructure includes energy, transportation, municipal water supply, and wastewater treatment, as well as industrial development. The environmental component is a significant portion in each. The U.S. environmental industry is, however, currently poorly positioned to service this demand because of its traditional do-

mestic focus and because of the intense trade competition U.S. firms are encountering around the world.

The trend in environmental markets in the developed and rapidly developing nations is to employ a more balanced variety of policy instruments than are used in the U.S., and supplement them with innovative tools, such as resource swaps. And, even where technology-specifying standards are employed, technical requirements and procedures differ from those in the U.S. Many nations have also coordinated domestic environmental and export strategies and use tactics that make their markets difficult ones for U.S. firms to compete in. Their firms benefit in their home markets and abroad from government cooperation that exceeds what is available to U.S. firms.

The industry's leaders say that greater coordination of U.S. government export programs, greater collaboration between the industry and government on behalf of environmental exports, and greater intra-industry collaboration will be needed, despite the promise of the recently formed Environmental Technologies Working Group (ETWG). In 1994, the principal federal agencies (DOC, EPA, DOE, AID, TDA, and the Export Import Bank) formed ETWG, which has been working towards an integrated and targeted approach to developing international environmental markets and enhancing U.S. industry's exports to these markets. ETWG's 1996 report outlined a comprehensive and strategic approach to support environmental technology exports. The elements of this strategy include the full range of support provided by the sponsoring agencies. These include: technical assistance and training, building capacity and demand in less developed (but emerging markets), financing, export promotion, and advocacy, direct support for U.S. environmental technology exports, and active assistance to U.S. companies to close international deals.

Outside the developed nations of North America, Western Europe, and Japan, a different but complementary approach is required for environmental business development, in the view of industry leaders. As developing and emerging nations attempt to catch up to the developed world in terms of standard of living and environmental quality, huge investments will need to be made in water, energy, and waste infrastructures and resource management systems, as well as in traditional pollution control and efficient industrial processes. Economics will play perhaps an even more vital role in these rapidly developing global environmental markets, where today environmental quality is perceived as a luxury, as will coordination with international financing institutions.

OFFICE OF TECHNOLOGY POLICY

U.S. environmental companies are facing stiff competition in global markets from companies whose governments provide financial incentives to prospective customers and impose fewer restrictions on trade practices. This offshore competition is affecting the composition and structure of U.S. environmental technology companies as they respond to decreased domestic demand and increased international opportunity. U.S. government officials and policy analysts have frequently highlighted the importance of exports in enhancing the vitality of the sector in terms of jobs and corporate performance. Analysts estimate that for every $1 billion in overseas sales of U.S. products and services approximately 14,000 jobs are created.

A partnership between government and the industry is required in world environmental markets, industry leaders say. The industry must provide products and services that are needed internationally. The government must improve coordination of U.S. export programs, as noted above, work closely with international finance institutions, and help companies work together. The environmental industry must more actively advocate reforms in international business promotion and in global and domestic policies that affect the industry.

Industry leaders suggest a number of policy instruments that are needed to support the environmental industry in its efforts to be the global leader. These include support for trade collaboration between the public and private sectors and overcoming structural impediments in U.S. law, tax code, and anti-trust issues.

In summary, industry believes there are opportunities for it and government to:

- *Further strengthen their partnership for international markets.*
- *Further coordinate U.S. government export programs.*
- *Enhance collaboration among companies to gain in international markets.*
- *Enhance coordination with international financing institutions.*